

## General

### Guideline Title

ACR Appropriateness Criteria® ductal carcinoma in situ.

### Bibliographic Source(s)

Kaufman SA, Harris EER, Bailey L, Chadha M, Dutton SC, Freedman GM, Goyal S, Halyard MY, Horst KC, Novick KLM, Park CC, Suh WW, Toppmeyer D, Zook J, Haffty BG, Expert Panel on Radiation Oncology-Breast. ACR Appropriateness Criteria® ductal carcinoma in situ [online publication]. Reston (VA): American College of Radiology (ACR); 2014. 20 p. [77 references]

### Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Moran MS, Bai HX, Haffty BG, Harris EE, Arthur DW, Bailey L, Bellon JR, Carey L, Goyal S, Halyard MY, Horst KC, MacDonald SM, Expert Panel on Radiation Oncology-Breast. ACR Appropriateness Criteria® ductal carcinoma in situ. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 14 p. [52 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

## Recommendations

### Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Ductal Carcinoma in Situ

Variant 1: 55-year-old woman with mammographically detected 2 cm comedo, high nuclear grade DCIS, ER-positive. Surgically excised, multiple foci of DCIS in lateral and medial specimen close to excision margin ( $\leq 1.0$  mm).

Treatment	Rating	Comments
<b>Principles of Treatment</b>		
Re-excision lumpectomy and RT if margins negative	9	
Mastectomy with LN staging	8	
Mastectomy without LN staging	7	Most surgeons would perform an SLNB.
Breast MRI prior to additional surgery	4	
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Treatment	Rating	Comments
Re-excision lumpectomy alone, no RT RT alone, no re-excision	2	
<b>RT Volumes (Assuming re-excision with widely negative margins)</b>		
Whole breast	9	
Boost to tumor bed	8	
PBI (assuming re-excision with widely negative margins)	4	This treatment is awaiting maturation of clinical trial data. It should be considered on protocol. Cautionary subgroup based on age and DCIS.
<b>RT Doses (1.8-2.0 Gy/day unless otherwise specified)</b>		
Whole breast: 42.5 Gy/16 fractions	7	Consider this treatment without boost.
Whole breast: 45-46.8 Gy/23-26 fractions	8	Consider this treatment with or without boost.
Whole breast: 50-50.4 Gy/25-28 fractions	9	Consider this treatment with or without boost.
Total cumulative dose: 40 Gy	3	
Boost dose 10 Gy in 2 Gy fractions after WBRT dose of 50 Gy (assume <1 mm margins, no re-excision)	3	A higher boost is indicated for close surgical margins.
Boost dose 16 Gy in 2 Gy fractions after WBRT dose of 50 Gy (assume <1 mm margins, no re-excision)	7	Though there are no phase III data for DCIS, most radiation oncologists would include a boost dose.
Boost dose 10 Gy in 2 Gy fractions (assume re-excision, widely negative margin of >1.0 cm)	7	Though there are no phase III data for DCIS, most radiation oncologists would include a boost dose.
Boost dose 16 Gy in 2 Gy fractions (assume re-excision, widely negative margin of >1.0 cm)	6	A boost dose of 16 Gy may be higher than necessary with widely negative margins.
<b>Systemic Therapy</b>		
Tamoxifen (5 years) after lumpectomy + RT	8	
<b>Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

**Variant 2:** 50-year-old woman with extensive pleomorphic microcalcifications in more than one quadrant on mammography. Area too large to excise with cosmetically acceptable outcome. Core biopsies demonstrate DCIS involving more than one quadrant.

Treatment	Rating	Comments
<b>Principles of Treatment</b>		
Mastectomy with SLNB	9	
Mastectomy without LN staging	4	Most surgeons would perform an SLNB with mastectomy.
Mastectomy with ALND	2	A full level I/II axillary dissection is not indicated without evidence of involved lymph nodes.
Attempt at lumpectomy with adjuvant RT	2	Consider this treatment in the case of microcalcifications in more than one quadrant.
Attempt at lumpectomy, LN staging, adjuvant RT	2	
Breast MRI prior to definitive surgery	2	This treatment provides no additional information if microcalcifications and biopsy suggest disease is in more than one quadrant and patient will have mastectomy.
<b>Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

**Variant 3:** 78-year-old woman with mammographically detected 1 cm, low nuclear grade DCIS, ER-positive. Surgically excised with 5 mm negative margins. Excellent performance status, no comorbidities. Plans to take a hormonal agent for 5 years.

Treatment	Rating	Comments
<b>Principles of Treatment</b>		
Adjuvant RT	8	
No RT (observation)	8	Consider observation for elderly patients or those with low-grade or negative margins.
<b>RT Volumes</b>		
Whole breast without boost	8	It is very reasonable to omit a boost for an elderly patient with a low-grade lesion excised with good margins.
Whole breast with boost	5	
Regional nodes	1	There is no indication for this treatment given extremely low incidence of lymph node involvement.
PBI	6	This treatment should be considered on protocol.
<b>RT Doses (1.8-2.0 Gy/day unless otherwise specified) (Assuming widely negative margins)</b>		
Whole breast: 42.5 Gy/16 fractions	8	This treatment is very reasonable in this elderly patient with good prognostic features.
Whole breast: 45-49 Gy	7	
Whole breast: 50-50.4 Gy	8	
Total cumulative dose, including any boost: 40 Gy	2	In this treatment, the dose is too low.
Total cumulative dose, including any boost: 50-50.4 Gy	8	
Boost dose 10 Gy in 2 Gy fractions after WBRT dose of 50 Gy	5	Consider the use of a boost dose, but the benefit is questionable.
Boost dose 16 Gy in 2 Gy fractions after WBRT dose of 50 Gy	3	In this treatment, the boost dose is too high.
<b>Systemic Therapy</b>		
Tamoxifen (5 years)	7	This treatment has robust data showing its efficacy.
Aromatase inhibitor (5 years)	4	There are no data to support use of this treatment, which is pending results of clinical trials. There is minimal potential benefit in this age group. Risks and benefits must be discussed with the medical oncologist.
<b>Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: 41-year-old premenopausal woman with mammographically detected 0.9 cm, intermediate nuclear grade, comedo DCIS, ER-negative. Surgically excised with widely negative margins.

Treatment	Rating	Comments
<b>Principles of Treatment</b>		
RT but no further surgery	9	
Breast MRI (after DCIS on biopsy and prior to definitive surgery)	4	Use of this treatment is unclear, but may detect additional disease in ipsilateral or contralateral breast, particularly in high grade DCIS.
LN staging and RT	2	LN staging is not necessary.
No further surgery or RT (observation)	2	This treatment for a patient who is premenopausal and has a high-grade tumor is contraindicated.
<b>RT Volumes</b>		
<b>Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>		
		Consider a boost, given the high-risk features of young age and high-grade disease despite lack of phase

Treatment	Rating	III data. Comments
Whole breast with boost	8	
PBI	3	This treatment should be considered on protocol.
<b>RT Doses (1.8-2.0 Gy/day unless otherwise specified) (Assuming widely negative margins)</b>		
Whole breast: 42.5 Gy/16 fractions (without boost)	7	
Whole breast: 45 Gy	8	
Whole breast: 50-50.4 Gy	9	
Total cumulative dose, including any boost: 40 Gy	2	The dose is too low.
Boost dose 10 Gy in 2 Gy fractions (in addition to whole breast 50 Gy)	8	Most radiation oncologists would include a boost dose.
Boost dose 16 Gy in 2 Gy fractions (in addition to whole breast 50 Gy)	6	The boost dose may be higher than necessary.
<b>Systemic Therapy</b>		
Tamoxifen (5 years)	3	Consider this treatment for ER-negative disease.
Trastuzumab for 2 cycles (if HER2/neu+)	2	This treatment should be considered on protocol.
<b>Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: 49-year-old premenopausal woman with mammographically detected 1 cm high-grade, comedo DCIS with single focus microinvasion, ER-positive. Surgically excised with widely negative margins (>5 mm).

Treatment	Rating	Comments
<b>Principles of Treatment</b>		
LN staging + adjuvant RT	9	
Mastectomy with LN staging	7	Consider this treatment if patient chooses mastectomy over BCT.
No LN staging required, proceed with adjuvant RT alone	5	Most surgeons would assess axilla surgically. Can be treated with radiation.
Mastectomy without LN staging	3	Most surgeons would perform an SLNB.
No LN staging, no adjuvant RT (observation)	1	In a premenopausal patient with high-grade disease and microinvasion, there is no role for observation.
<b>RT Volumes (Assuming negative margins and negative SLNB)</b>		
Postmastectomy chest wall	1	There is no indication for radiotherapy after mastectomy.
Whole breast without boost	7	Use of a boost is generally endorsed for premenopausal high-grade cases.
Whole breast with boost	8	
Regional nodes	2	There is no indication for regional nodal irradiation with a negative SLNB.
PBI	3	This treatment should be considered on protocol.
<b>RT Doses (1.8-2.0 Gy/day unless otherwise specified) (Assuming widely negative margins)</b>		
Whole breast: 42.5 Gy/16 fractions	8	
Whole breast: 50-50.4 Gy	8	
Total cumulative dose, including any boost: 40 Gy	2	The dose is too low.
Whole breast 50 Gy + boost 10 Gy	8	
Whole breast 50 Gy + boost 16 Gy	6	This dose may be higher than necessary.
<b>Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate</b>		

Systemic Therapy Tamoxifen (5 years)	Treatment	Rating	Comments
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 6: 60-year-old woman with new microcalcifications on screening mammography. Stereotactic core biopsy shows pure pleomorphic LCIS, ER/PR-negative.

Treatment	Rating	Comments
<b>Principles of Treatment</b>		
Surgical excision for clear margins	7	For this treatment, rule out invasive component; biologically, the disease may behave more like high-grade DCIS than classical LCIS.
Mastectomy	5	This treatment is reasonable if clear margins cannot be achieved with lumpectomy.
Whole-breast RT	3	There is no direct evidence to support efficacy.
Observation (no surgical excision)	2	Lesions are often associated with invasive malignancy.
Surgical excision with LN staging	2	There is no indication for lymph node evaluation in the absence of invasive disease.
<b>Systemic Therapy</b>		
Tamoxifen (5 years)	8	This treatment is appropriate for chemoprevention regardless of hormone receptor status.
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 7: 41-year-old premenopausal woman with mammographically detected 0.9 cm, high nuclear grade DCIS, plus comedo necrosis, ER-negative. Surgically excised. Assume final margins >1 cm, patient wants partial breast irradiation.

Treatment	Rating	Comments
PBI	3	This treatment should be considered on protocol.
<b>Systemic Therapy</b>		
Tamoxifen (5 years)	2	
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 8: 58-year-old postmenopausal woman with mammographically detected 1.9-cm, intermediate nuclear grade solid DCIS, ER-positive. Surgically excised. Assume final margins >1 cm, patient wants partial breast irradiation.

Treatment	Rating	Comments
PBI	6	This treatment should be considered on protocol.
<b>Systemic Therapy</b>		
Tamoxifen	8	
<b>Rating Scale:</b> 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

## Summary of Literature Review

### Introduction

Ductal carcinoma in situ (DCIS; intraductal carcinoma) is a noninvasive breast cancer originating from the cells that line the mammary ducts. The term encompasses a broad range of diseases ranging from low-grade, indolent lesions to high-grade, aggressive tumors that can be a precursor to invasive disease. Patients with DCIS can be asymptomatic at the time of presentation (radiographic findings on mammogram) or present with symptoms such as a palpable mass or nipple discharge. The incidence of DCIS has markedly increased in the past decade, primarily due to improved screening utilization and imaging techniques. This has led to a shift in disease presentation from years past where patients with DCIS had symptomatic findings to the current era in which these lesions are most commonly detected solely in the process of evaluating abnormal mammographic findings.

Pathologically, DCIS is defined by the presence of malignant epithelial cells within the well-defined breast ducts. The malignant cells are, by definition, bound by an intact basement membrane without any basal myoepithelial layer invasion. There are several architectural subtypes of DCIS: solid, comedo, micropapillary, papillary, and cribriform. Furthermore, DCIS is classified qualitatively by nuclear grade (high, intermediate, and low based on cytologic/structural features) and the presence or absence of necrosis. Often, patients with DCIS have lesions that contain at least two architectural subtypes. Although pathologic criteria have been established to classify DCIS in comparison to normal hyperplasia and atypical ductal hyperplasia (ADH), the diagnosis can still be very challenging for pathologists, as these entities represent a continuum of cellular and architectural atypia. Distinguishing between ADH and DCIS can particularly be difficult, as demonstrated by significant differences in diagnosis on expert pathology review.

There are three general treatment approaches for women with DCIS: 1) mastectomy 2) breast-conserving surgery (BCS) alone, encompassing wide local excision, lumpectomy, quadrantectomy, and partial mastectomy; and 3) BCS followed by radiotherapy, classically defined as breast-conservation therapy (BCT). Historically, mastectomy was the standard treatment for this disease. Over the last two decades, the treatment has shifted to a breast-conserving approach (i.e., lumpectomy with or without definitive breast irradiation) for patients with DCIS localized to one quadrant, if the disease is resectable with acceptable cosmesis. The standard radiation treatment has used conventionally fractionated, whole-breast radiation, delivered daily over 5 to 7 weeks. In more recent years, there has been a resurgence of two accelerated regimens for both DCIS and invasive breast cancers: 1) accelerated partial-breast irradiation (PBI), delivering biologically equivalent doses of radiation to only a portion of the breast for a shorter period (typically  $\leq 5$  days) and 2) hypofractionated whole-breast radiation therapy performed over approximately 3 weeks.

The management of DCIS remains controversial for several reasons. Although there are no randomized trials comparing BCT to mastectomy for DCIS, comparisons of BCT to historic mastectomy controls suggest no difference in overall survival. In terms of breast conservation, there are four published randomized trials for DCIS evaluating the benefit of adjuvant whole-breast radiotherapy after local excision: the National Surgical Adjuvant Breast and Bowel Project (NSABP) B-17, the European Organization for Research and Treatment of Cancer (EORTC) 10853, the UK/Australia/New Zealand (UK/ANZ) cooperative trial, and the Swedish trial. All suggest a benefit in local control with the addition of whole-breast radiation compared with lumpectomy alone (with or without tamoxifen).

Because of the heterogeneity of DCIS, it is unclear whether all patients with DCIS uniformly benefit from treatment. Although it appears, based on retrospective series, that there is an increased propensity for local recurrence after BCT for comedo histologies, high-grade lesions, close/positive surgical margins, and younger patients, there is a paucity of complete data on these prognostic factors. The limited existing randomized DCIS studies do not adequately address the relative impact of these various factors in a prospective manner, nor do they address whether a subgroup of patients with low-risk DCIS has a small enough potential benefit from radiation that it may be deferred. Thus, it is unclear how to factor all of the possible clinical and pathologic elements into the decision-making process. Additional prospective studies incorporating these variables into therapeutic interventions are required before they can be routinely used to guide treatment decisions. Furthermore, the randomized data assess the benefit of adjuvant, whole-breast radiation after local excision, but a more recent trend toward PBI has not been adequately studied. The existing body of literature on PBI for DCIS consists mainly of retrospective analyses with relatively short follow-up.

Additionally confounding the data, the proportion of patients with DCIS detected by physical findings and symptoms has decreased significantly with the increased use of screening mammography. Thus the earlier literature reporting on clinically symptomatic DCIS patients is not directly applicable to and cannot be used to guide decision-making for patients diagnosed in the current era in which the vast majority of patients have subclinical disease at presentation that is subsequently detected, mainly by mammography. Furthermore, it is now more apparent that the variations in clinical and pathologic presentations of DCIS subtypes and the differences in their natural histories suggest that DCIS is not one entity, but rather a spectrum of diseases that ultimately may require different management approaches. Unfortunately, there are insufficient long-term data assessing the efficacies of the various treatment modalities for the different subtypes of DCIS. Lastly, there is a paucity of data on the natural history of DCIS in the untreated patient.

More recently, the addition of tamoxifen has been shown to help prevent recurrence of ipsilateral breast cancer in some groups of DCIS patients.

The use of tamoxifen as a therapeutic option after BCS (with or without radiation) has added to the complexity of therapeutic decision-making, but must also be considered in hormone-receptor-positive DCIS patients as a means of decreasing in-breast recurrence. Complicating treatment considerations further, tamoxifen is also beneficial in reducing contralateral breast cancers. The role of aromatase inhibitors for DCIS is under active investigation. Since the focus of this document is on local treatment, management and prevention of local relapse, tamoxifen and other antiendocrine agents will be discussed below as they relate to or affect local treatment choices.

Several ongoing randomized trials are attempting to address many important local and systemic therapies for DCIS: Radiation Therapy Oncology Group® (RTOG) 1005, NSABP B-43, Tasman Radiation Oncology Group (TROG) 07.01, and the French Multicentric BONBIS Trial.

## Local Treatment Variables

### *Mastectomy*

Many reasons have been cited to justify the use of mastectomy as the initial treatment of intraductal carcinoma. First, the rate of occult multicentricity found in mastectomy specimens is approximately 20% to 30%. This rate, however, may be decreasing, as tumors are being detected earlier with wider use of screening mammography. Second, the rate of occult invasive disease found in mastectomy specimens is approximately 10%. Third, residual normal breast tissue left in the patient after BCS might undergo malignant transformation over time; mastectomy essentially eliminates this possibility. Fourth, there is a significant risk of invasive recurrence after BCT, and invasive cancers are theoretically more life-threatening than DCIS. Lastly, mastectomy series consistently provide the highest relapse-free survival rates of any treatment approach, albeit without improvement in disease-free or overall survival.

The reported outcome after treatment with mastectomy shows survival rates of 96% to 100%. Local-regional control rates are also reported as 96% to 100%. However, survival and local-regional results are virtually always reported using crude outcome calculations. The lack of actuarial outcome analyses for mastectomy series is a serious impediment to comparison with breast-conservation series, which have typically been reported with actuarial outcome calculations. Although the recent emphasis on the treatment of DCIS has focused on BCT instead of mastectomy, no prospective, randomized trials have included a mastectomy arm to date (mainly due to the number of patients that would be required to test for a potential survival advantage of 1% to 3% over BCT, which would be so large that accruing patients would not be feasible). Furthermore, it would be difficult, if not impossible, to convince the needed number of women to agree to randomization between two such drastically different local therapies in contemporary practice. Therefore, the absence of a mastectomy arm in current prospective, randomized trials will preclude the definitive comparison of mastectomy with BCT.

Although breast-conserving approaches have replaced mastectomy for DCIS in most cases, there are a few instances in which a mastectomy may be indicated. These include multicentric DCIS, unattainable negative margins, patient choice, large tumor size relative to small breast size, diffuse microcalcifications on imaging studies, and DCIS associated with BRCA mutation (where patients may elect for bilateral mastectomies). For a discussion on the use of postmastectomy chest wall irradiation in cases of pure DCIS, please see the National Guideline Clearinghouse (NGC) summary of the [ACR Appropriateness Criteria® postmastectomy radiotherapy](#) (see Variant 1 and Variant 2 above).

### *Breast-Conservation Approaches*

The components of treatment that need to be considered in a DCIS patient motivated to receive breast conservation can be divided into three major categories:

1. BCS to remove all disease and suspicious calcifications and achieve a negative surgical margin.
2. Adjuvant radiation therapy, used to further decrease local relapse after BCS. Can be divided into three delivery methods:
  - Standard, conventionally fractionated, whole-breast radiation (delivered daily over 5 weeks with or without boost).
  - Accelerated PBI, where a limited portion of the breast at highest risk for local recurrence is radiated in a shorter course, typically  $\leq 5$  days.
  - Accelerated hypofractionated whole-breast radiation, in which the whole breast is radiated with higher daily fraction size for a shorter overall treatment time of approximately 3 weeks.

The following will review data on the radiation delivered with conventionally fractionated, whole-breast treatment for DCIS. The data on accelerated PBI and hypofractionated whole-breast radiation therapy as they pertain to DCIS will be discussed in a separate section in this guideline.

3. Tamoxifen for 5 years in hormone-receptor-positive DCIS (used in a few of the randomized trials) to further reduce in-breast recurrence rates.

Although both the addition of radiotherapy and tamoxifen have been shown to independently improve local control in randomized, prospective studies, the question remains whether subsets of DCIS patients have limited benefit and can forgo these adjuvant treatments since neither confers a



survival benefit.

### *Breast-Conserving Surgery Followed by Radiation Therapy*

Single-institution data on patients treated with surgical excision followed by radiation therapy demonstrate breast failure rates of 16% to 18% at 20 years. One group of researchers updated the largest multi-institutional experience of DCIS and reported a 15-year actuarial local failure rate of 19%. Subset analyses demonstrated local failure rates of  $\leq 8\%$  for patients with negative margins or age  $\geq 50$  years. The cause-specific survival rate for these conservatively managed patients was an excellent 98% at 15 years, which is comparable to the results of mastectomy series.

Re-evaluation of the pathologic material from NSABP B-06 (a randomized trial evaluating post-lumpectomy breast radiation for invasive breast cancer) revealed that 76 patients had in situ rather than invasive breast cancer. Local failure rates for the patients treated with excision versus excision followed by radiation therapy were 43% and 7%, respectively, at a mean follow-up interval of 83 months.

As mentioned above, four prospective, randomized trials have been published to date comparing excision alone with excision followed by radiation therapy (with or without tamoxifen). A fifth trial has not yet been published, but the data have been presented. All trials treated the whole breast to 50 Gy in 5 weeks without the use of a boost. The first trial, NSABP B-17, has the longest follow-up of 20 years. It randomized patients after lumpectomy to radiation versus no radiation (tamoxifen was not used) and demonstrated that local failure was reduced from a crude rate of 35% without radiation to 19.8% with radiation. The inclusion criteria for this study were localized DCIS of any histology detected either clinically or mammographically, with negative margins following excision (defined as no tumor cells on the inked resection margin). The 12-year data revealed that radiation therapy has a greater impact on reducing the incidence of invasive recurrences, the potentially life-threatening form of recurrence (relative risk [RR]=0.38,  $P=0.00001$ ), but also significantly reduces noninvasive recurrences (RR=0.49,  $P=0.001$ ). Local failure was significantly increased for patients with questionable or positive surgical margins and for those with marked to moderate comedo necrosis.

The EORTC 10853 trial for DCIS randomized patients after lumpectomy to radiation versus no radiation without use of tamoxifen. In the 15-year update, the risk of any local recurrence was reduced by 48% with the addition of radiotherapy. The 15-year local recurrence-free rate was increased from 69% with excision alone to 82% with the addition of breast radiation ( $P<0.001$ ). No differences for breast cancer-specific survival or overall survival were observed. The risk of recurrence was greatest in the first 5 years after treatment, with hazard rates of 4.0% per year after excision alone versus 2.0% per year with the addition of radiotherapy. These rates decreased to 2.0% and 1.2% in the second 5 years, and 1.3% and 0.6% after that.

Similar to the long-term outcomes in the B-17 trial, radiation significantly reduced invasive and DCIS recurrences in this trial. Factors that predicted an increased local recurrence on multivariate analysis included age 40 years or younger, palpable DCIS lesions, involved surgical margins, cribriform and solid histologic subtypes, and treatment with lumpectomy only.

The UK/ANZ DCIS randomized trial had a more complex design in which, after study enrollment, patients were entered into a modified 2x2 randomization of with or without radiation therapy and with or without tamoxifen, or elect randomization to only with or without radiation therapy or with or without tamoxifen. Notwithstanding the complexity of the study design, the published results (median follow-up of 12.7 years) demonstrated a reduction in ipsilateral breast cancer recurrence rates with the addition of radiotherapy (19.4% versus 7.1%,  $P<0.0001$ ).

A phase III trial originating from Sweden (the SweDCIS Trial) also demonstrated a benefit to adjuvant radiation. At a mean follow-up of 8 years, the cumulative incidence of ipsilateral breast events in the radiation arm (12.1%) was comparably less than that of the observation arm (27.1%) with a corresponding RR of 0.40 (95% confidence interval [CI], 0.30 to 0.54). A notable difference in this protocol from the aforementioned trials was that this study did not require microscopically negative margins prior to radiation; 10% of the patients had positive surgical margins in this study.

Data from these four trials were pooled in a meta-analysis performed by the Early Breast Cancer Trialists' Collaborative Group. The 10-year risk reduction of any ipsilateral breast event was 15.2% (12.9% versus 28.1%,  $P<0.00001$ ); effectiveness was significant regardless of risk factors such as age, grade, margin status, detection method, tumor size, presence of comedonecrosis, or use of tamoxifen. As with the individual trials, no difference in overall survival was observed.

The results of the RTOG 98-04 were recently presented at two national meetings and have appeared in abstract form. This phase III randomization trial specifically examined the benefit of radiotherapy after excision in "favorable" DCIS cases (asymptomatic, grade 1–2, size  $\leq 2.5$  cm, and margins  $\geq 3$  mm). Although the trial closed early due to low accrual, the 7-year recurrence rates were 6.7% without radiotherapy versus 0.9% with ( $P=0.0003$ ), corresponding to a hazard ratio of 0.11. Of note, though the majority were treated with standard fractionation, 8.4% of the patients enrolled received a hypofractionated whole-breast regimen. This trial reinforces the idea that all patients with DCIS (even those with favorable clinical and pathologic features) will have a lower chance of local recurrence with postlumpectomy radiation. However, the magnitude of this benefit may be small in a favorable subset such that some patients and physicians may consider the benefit not of clinical significance.



In summary, all five of these randomized, prospective trials have consistently demonstrated a significant improvement in local control with the use of adjuvant radiation, with a risk reduction of both invasive and in situ ipsilateral breast recurrence rates of >50% with the addition of postlumpectomy whole-breast radiotherapy, with no difference in overall survival (these studies were not powered to detect a survival difference).

### *Excision Alone*

The primary criticism of the currently published randomized DCIS trials is the lack of stratification before randomization by tumor grade, histology, or size because such stratification might have identified a subset of patients that may be adequately treated with excision alone. Selected patients have been managed with excision alone in retrospective studies. The criteria for consideration of excision alone in these studies were similar: lesions detected mammographically, without a palpable component, measuring  $\leq 25$  mm, and with negative margins following excision; with local failure rates reported to be 10% to 15%, comparable to single-institution reports of surgical excision followed by radiation therapy in less rigorously selected patients. These series also note that most of the breast failures were in patients with tumors of the comedo subtype, or inadequate margins, and young patients. For patients treated with lumpectomy alone, one study reported that the risk of local recurrence was reduced with increasingly wide negative margins of resection.

The Van Nuys Prognostic Index, adopted from a review in which a risk category was developed based on margin status, histologic subtype, tumor size, and patient age using a cohort of DCIS patients treated from two institutions, continues to be used by some practitioners as part of their decision-making process for adjuvant radiation after local excision. It is important to note that the data from this "scoring system" were derived from retrospective data, and that all randomized prospective data published to date have consistently demonstrated an improvement in local control in all patients.

Other groups have attempted to identify subgroups of DCIS patients, using a prospective study design, who may have minimal benefit from radiotherapy. A notable single-arm prospective protocol of highly selected small, low-grade DCIS patients treated with BCS with widely negative margins of  $\geq 1$  cm was initiated in Boston but was closed early due to the high number of local recurrences with observation alone. The RTOG 98-04 trial discussed previously, which was designed to assess the outcomes of observed versus radiated low-risk DCIS patients after BCS, did show a local control benefit to radiotherapy although it was closed prematurely due to lack of accrual.

The Eastern Cooperative Oncology Group (ECOG) initiated a prospective, single-arm trial (E5194) of observation for low- and intermediate-risk DCIS. The stratification of the two cohorts in this study included the low-risk group, defined as low-grade or intermediate-grade DCIS measuring  $\leq 2.5$  cm; and intermediate-risk group, defined as high-grade DCIS measuring  $\leq 1$  cm with negative margin widths of  $\geq 3$  mm. It is notable that the average tumor sizes for the low-risk and intermediate-risk cohorts were only 6 mm and 5 mm (when enrollment guidelines allowed for  $\leq 25$  mm and  $\leq 10$  mm, respectively), suggesting that the patients enrolled in this trial were highly selected with tumors significantly smaller than permitted by the protocol eligibility. With a median follow-up of 6.7 years for the low-risk group and 6.2 years for the intermediate-risk group, the 5-year ipsilateral breast relapse rates were 6.1% and 15.3%, respectively; at 7 years this increased to 10.5% and 18.0%. Given the long natural history of DCIS, often with late recurrences (>10 years), particularly in low- and intermediate-grade DCIS, these data are considered early results and longer follow-up is required. Interestingly, researchers at two institutions recently published the combined outcomes over a 29-year interval of 263 patients from their hospitals who were treated with excision and whole-breast radiotherapy who would have met the entry criteria for E5194. They found a more than 70% lower local recurrence rate at 5 years compared to excision alone on E5194 for both the low-risk (1.5% versus 6.1%) and high-risk groups (2% versus 15.3%).

A subsequent analysis of the E5194 cohort applied a 12-gene assay to validate a derived recurrence risk score (the 12-gene Oncotype DX DCIS score) to predict those for whom radiotherapy would be of minimal benefit. Further validation is necessary before routine use of this genetic profile in determining clinical decisions (see Variant 3 and Variant 4 above).

### *Systemic Therapy*

Because DCIS is a process confined within the ductal system of the breast, it has no potential to spread to distant body sites. Thus, there is no need to deliver any therapy that would treat the patient "systemically" (i.e., with chemotherapy or antiendocrine therapy to treat organs beyond the breast). However, BCT has been improved (yet made more complex) by the recent appreciation that antiendocrine therapy (using tamoxifen) impacts local control in the breast conservation setting. Results of NSABP B-24 trial demonstrated that the addition of tamoxifen to postlumpectomy breast radiotherapy for DCIS significantly reduced ipsilateral breast tumor recurrences (RR=0.60, 95% CI=0.38-0.96) but did not an impact on survival. Further progress was made when a group of researchers analyzed subsets of patients treated in the NSABP B-24 trial and found that the benefit in local control with tamoxifen was associated with patients with estrogen-receptor (ER)-positive only. As a result, all DCIS lesions should routinely undergo hormone receptor status assessment prior to consideration of eligibility for tamoxifen. The role of tamoxifen in the setting of DCIS treated with mastectomy has not been determined to date.

Another group of researchers analyzed data from 2,615 women with primary DCIS who participated in the NSABP B-17 and B-24 trials for ipsilateral breast tumor recurrence; patients were followed for a median of 207 months on B-17 and 163 months on B-24. Ipsilateral breast tumor

recurrence was a first failure in 490 patients (263 invasive, 227 noninvasive). The 15-year cumulative incidence of all such recurrences was 35% for lumpectomy only, 19.8% for lumpectomy with whole-breast irradiation plus placebo and 13.2% for lumpectomy with whole-breast irradiation plus tamoxifen.

Currently there are no published phase III data on the use of aromatase inhibitors for DCIS. Both NSABP B-35

([http://www.nsabp.pitt.edu/NSABP\\_Protocol\\_Chart.pdf](http://www.nsabp.pitt.edu/NSABP_Protocol_Chart.pdf)) and IBIS-II/BIG 5-02 (<http://www.ibis-trials.org/ethicals/ibis2-dcis>) have completed accrual in the comparison of anastrozole to tamoxifen as adjuvant therapy for DCIS. Because DCIS expresses human epidermal growth factor receptor 2 (HER2/neu) more often than invasive cancers, the benefit of trastuzumab for HER2/neu-positive DCIS is being evaluated in a phase III trial of adjuvant trastuzumab in the NSABP B-43 trial, in which patients will receive 6 weeks of whole-breast irradiation and be randomized to two cycles of trastuzumab delivered concurrently with radiation versus no systemic therapy (see Variant 3 and Variant 4 above).

### The Role of Surgical Assessment of the Axilla in DCIS

There is currently no role for axillary dissection in the management of DCIS, even for high-grade or comedo lesions, because in theory pure DCIS is preinvasive and should not metastasize. Although the risk of axillary involvement for pure DCIS approaches 0% in contemporary studies, the preoperative diagnosis of DCIS by core-needle biopsy is upstaged after the definitive procedure in as many as 9% to 15% of patients, requiring these patients to subsequently undergo a separate second surgical procedure to evaluate the axilla. Furthermore, contemporary series suggest that there is a difference in lymph node involvement for patients with DCIS diagnosed at biopsy (10% node positive) versus pure DCIS after definitive surgery (5% node positive) as well as DCIS with microinvasion (9% node positive) versus pure DCIS (5% node positive).

These contemporary series use the sentinel lymph node biopsy (SLNB) procedure to assess the axillary nodal status in lieu of a full axillary dissection, thus diminishing the morbidity of surgical evaluation of the axilla while preserving the accuracy of surgical nodal evaluation. As a consequence, there is renewed discussion as to the appropriateness of surgical evaluation of the axilla for DCIS using SLNB to identify patients at increased risk for nodal involvement, in order to prevent an additional delayed procedure after the definitive local surgery.

From the more detailed histopathologic evaluation of lymph nodes removed from SLNB compared to axillary dissection, reports of positive SLNBs have been described in up to 12% of cases of DCIS, but the clinical relevance of a positive SLNB in the setting of pure DCIS has yet to be demonstrated. Currently, the few studies reporting the impact of SLNB on DCIS patients is limited mainly to single institutional series, and it remains particularly unclear how micrometastasis or isolated tumor cells in lymph nodes affect outcomes or should influence management.

As a result, although SLNB is not a routine component of breast-conserving surgical management of most patients with DCIS, it is used in specific situations. For example, in patients undergoing mastectomy with the preoperative diagnosis of DCIS, an SLNB is often advocated, due to the greater than 10% risk of occult invasive disease in the mastectomy specimen and the greater than 10% sentinel node positivity. If SLNB is not performed at the time of mastectomy, the ability to perform an SLNB procedure subsequent to mastectomy is precluded, with delayed complete axillary dissection as the only option for surgical evaluation of the axilla. In DCIS patients with radiographic evidence of extensive disease or tumor size measuring >2.5 cm, SLNB may also be considered, as the risk of nodal involvement appears to rise with increased size of DCIS.

### Microinvasive Disease (DCIS with Microinvasion)

Microinvasive carcinoma (DCIS with microinvasion) is pathologically defined by the presence of early and minimal penetration of the duct wall by cancer cells beyond the basement membrane as seen by conventional light microscopic evaluation. Although special staining can be used to demonstrate the absence of a myoepithelial layer surrounding the tumor cells to define a tumor that has invaded beyond the confines of a duct, there remains some controversy as to the exact definition of microinvasion for DCIS due to variations in the quantitative definitions. Many publications use the criteria of  $\leq 2$  mm of invasion, whereas the American Joint Committee on Cancer specifically defines microinvasion as  $\leq 0.1$  cm (T1mic). The presence of unequivocal invasion is required for the diagnosis; cases with equivocal invasion should not be considered microinvasion. Cases with >2 mm of invasion are sometimes considered as having "minimal invasion" but should be distinguished from microinvasion (T1mic) as an invasive cancer (T1a).

Limited information has been reported regarding treatment outcome for microinvasive carcinoma of the breast as a separate entity. Typically, DCIS with microinvasion cases are included with early-stage invasive disease (e.g., T1a lesions). Thus, there are limited data on DCIS with microinvasion, although the actual diagnosis of microinvasive carcinoma is increasing due to improved early detection. No randomized trials have evaluated therapy for microinvasive disease. Modern single institution series do not indicate a worse outcome for DCIS with microinvasion than that of comparable cases of high-grade DCIS.

For regional nodal management, microinvasive carcinoma carries a small but real risk of axillary lymph node metastasis, with nodal involvement ranging from 3% to 10%, although higher and lower risks have been reported. With the development of SLNB techniques, the decision to evaluate the axilla surgically is a less difficult one, given the reduced morbidity of the procedure compared with axillary node dissection and the large impact

a positive lymph node would potentially have on systemic management of a patient with a microinvasive primary. Many clinicians now include pathologic axillary staging (for example, with an SLNB) as a standard part of surgical management of this disease.

The major difference in the local management of DCIS with microinvasion compared with pure DCIS is that lumpectomy alone is not considered a standard management option for microinvasive carcinoma of the breast. The possible exception to this caveat would be in the setting of an ER-positive microinvasive tumor in a postmenopausal "elderly" woman following lumpectomy who will be receiving adjuvant hormonal therapy. In the Cancer and Leukemia Group B (CALGB) randomized trial of lumpectomy followed by tamoxifen alone versus tamoxifen and radiation for women 70 years of age and older with T1 tumors (which presumably included but did not specifically evaluate those with microinvasive disease), the recent update showed only a modest benefit with the use of radiation (breast relapse-free survival rates of 98% vs 91% at 10 years). Although the existing data on DCIS with microinvasion are retrospective with small numbers of patients, a recent relatively large, single institutional series reported long-term outcomes of pure DCIS compared to microinvasive DCIS with microinvasion treated with BCS and radiation therapy and found no significant differences in local relapse, disease-free survival, or overall survival. Though somewhat conflicting, these studies collectively suggest that the microinvasion in and of itself may not confer a worse prognosis; the clinical behavior may be related to the pathologic features of the underlying DCIS (e.g., comedo necrosis, high-grade disease) (see Variant 5 above).

#### Pleomorphic Lobular Carcinoma in Situ

Pleomorphic lobular carcinoma in situ (PLCIS) is a histologic finding distinguished from classical lobular carcinoma in situ (LCIS) by enlarged and often irregular nuclei. PLCIS has features similar to high-grade DCIS such as comedonecrosis and microcalcifications, which can be detected radiographically in most cases. Biologically, PLCIS carries the hallmarks of a more aggressive entity than classical LCIS including a high Ki-67 index, p53 protein accumulation, a lack of estrogen and progesterone receptor expression, and a tendency toward HER2 overexpression and amplification. Like classical LCIS, however, these lesions typically do not express E-cadherin and are therefore distinguishable from DCIS.

The more aggressive histologic profile of PLCIS has led to recommendations for treatment as a precursor lesion to invasive malignancy (similar to DCIS), including resection to clear margins and consideration for adjuvant radiotherapy. PLCIS has a higher rate of association with invasive malignancy than classical LCIS, strengthening the argument for complete excision. At the time of this writing, however, limited clinical data exist to support the malignant potential for PLCIS. As such, there is a paucity of evidence to support the routine use of radiotherapy (see Variant 6 above).

#### Use of Magnetic Resonance Imaging in DCIS

The use of breast magnetic resonance imaging (MRI) is increasingly prevalent in the preoperative management of invasive breast cancers and, more recently, for DCIS. Early in the era of breast MRI, this mode of imaging was felt to be less sensitive than mammography for pure intraductal cancers, and thus its use in the workup of DCIS was discouraged. More recently, it has become apparent that the diagnostic criteria for MRI assessment of DCIS differ from those of invasive cancers and that MRI does allow for more effective diagnosis of DCIS. Several studies indicate that breast MRI is more sensitive in detecting multicentric disease for DCIS compared with mammography. For estimating the size of DCIS lesions using MRI, conflicting results have been published. Generally it is felt that MRI provides an overall improvement of size estimation for DCIS compared with mammography but with both overestimation and underestimation of tumor size compared with pathologic analysis. Breast MRI has been found to be more sensitive for detecting intermediate and high-grade DCIS. Lastly, recent reports suggest that the varied morphology of DCIS seen on breast MRI is a reflection of the heterogeneous differences of DCIS pathology. For example, clumped enhancement patterns are more associated with high-grade lesions than more heterogeneous patterns, and small focal masses are associated with ER-positive DCIS. There are several advantages in using an MRI in the preoperative setting: its high sensitivity for DCIS that ranges from 72% to 84%; the possibility of detecting DCIS without microcalcifications that are mammography occult; its ability to better assess for multicentricity than mammography; its ability to outperform mammography in dense breasts; and its ability to improve on the size estimation for guiding local treatment decisions. These pluses have to be weighed against the disadvantages, including high false-positive rates potentially requiring unnecessary further workup and additional invasive procedures, delay of definitive treatment for the known malignancy, and increased anxiety for the patient. It is important to note that although no studies to date demonstrate a benefit in outcomes with the use of MRI for DCIS, the use of breast MRI in DCIS has been shown to decrease the need for re-excisions secondary to incomplete surgical removal and positive margins.

#### Accelerated Partial Breast Radiation (PBI)

Though accelerated PBI is being increasingly used for breast cancer, there are no randomized, prospective studies published to date reporting its long-term efficacy compared with standard, conventionally fractionated, whole-breast radiation. Although some well-controlled, prospective, single-arm studies exist for invasive cancers and for DCIS specifically, there is a paucity of such data. Though not a traditionally "prospective" study, the most notable experience of accelerated PBI for DCIS comes from the American Society of Breast Surgeons MammoSite® registry trial, an analysis of patient data collected from 97 institutions that allowed for treating physicians to enter patient information at any time before, during, or after MammoSite® treatment for future analysis and study. In the most recent update, at 5 years, of the 194 (13%) patients in the

registry who had DCIS, the 5-year actuarial local relapse was 3.39% with the use of MammoSite®, comparable to historic controls of conventionally fractionated, whole-breast radiation. A recently published subset analysis of the MammoSite® registry trial compared the outcomes of those patients who would have met entry criteria for the E5194 trial with the ECOG trial results. Compared to historically matched control patients treated with excision alone on the E5194 trial, the MammoSite® patients had fewer recurrences at 5 years for both the low/intermediate grade (0% versus 6.1%) and the high-grade cohorts (5.3% versus 15.3%). An independent prospective, multicenter trial conducted between 2003 and 2009 of BCS plus MammoSite® treated 41 DCIS patients (42 breasts). The 5-year actuarial rate of ipsilateral breast tumor recurrence was 11.3%; none of those recurrences were within the treatment area.

Due to the limited data using the various accelerated PBI modalities for DCIS, the American Society for Radiology Oncology (ASTRO) recently published a consensus statement regarding the use of accelerated PBI, where three categories of appropriateness were generated based on the level of prospective data and follow-up: suitable, cautionary, and unsuitable. Due to the limited prospective data on PBI for DCIS, this disease entity was categorized in the "cautionary" group. Similarly, the Breast Cancer Working Group of the Groupe Européen de Curietherapie and the European Society of Therapeutic Radiology recently published guidelines of three categories for patient selection for accelerated PBI where DCIS was placed in the "intermediate" risk group.

A randomized phase III trial recently closed to accrual (with DCIS or invasive tumors  $\leq 3$  cm) designed to determine the relative efficacy and toxicity of accelerated PBI compared to whole-breast radiotherapy (NSABP B-39/RTOG 0413). Patients randomized to PBI received either luminal-based brachytherapy, interstitial brachytherapy, or 3-dimensional (3-D) conformal external beam radiation. Five-year data have been presented indicating low rates of high-grade toxicity with 3-D conformal external beam accelerated PBI at a mean follow-up of 41 months (3% grade 3; 0% grade 4-5). Data are maturing to assess the overall efficacy of PBI as well as cosmesis and the brachytherapy toxicity profile (see Variant 7 and Variant 8 above).

#### Hypofractionated Whole-Breast Radiation

There has been a recent resurgence of hypofractionated whole-breast radiation for women with early-stage breast cancer. Several single and multi-institution series have demonstrated acceptable local failure rates with up to 5 years of follow-up for DCIS treated with accelerated whole-breast regimens. There are now four prospective, randomized trials confirming that treatment with accelerated, hypofractionated radiation with doses of 39 Gy to 43 Gy in 13 to 16 fractions provides local tumor control comparable to that provided by standard fractionation of 50 Gy in 25 fractions, with equivalent acute and late effects of treatment in patients with early-stage invasive breast cancers. Although these trials did not specifically assess hypofractionated radiation in DCIS patients, long-term data suggest no difference in hypofractionated, whole-breast radiation compared to the standard fractionation in terms of local control, cosmesis, and other long-term effects in the setting of breast conservation. Although patients in these trials had invasive disease, the cosmetic and long-term effects would not be expected to be different in DCIS. Though the presumption is that local control rates for DCIS using hypofractionated whole-breast radiation would be comparable to the standard fractionation schemes, patients with DCIS were excluded from the randomized hypofractionation whole-breast trials. However, many institutions have adopted use of hypofractionated regimens for DCIS given the compelling results of retrospective series and reasonable parallels drawn with prospective data for early-stage invasive disease.

Based on the lack of available prospective randomized data, a recent ASTRO task force concluded that at this time there are insufficient data to allow an evidence-based recommendation for or against hypofractionated whole-breast radiation for women with DCIS. The panel did feel hypofractionation was equivalent to standard fractionation for T1-2 N0 tumors. Outside of tumor stage, selection criteria were age (50 or greater), dose heterogeneity (no more than  $\pm 7\%$  along the central axis), and lack of systemic therapy. An ongoing, randomized phase III study, TROG 07.01/BIG 03-07/IBCSG Trial 38-10 is studying radiation doses and fractionations specifically for DCIS of the breast. The RTOG 1005 trial is also actively enrolling patients to investigate the utility of an integrated concurrent tumor bed boost within a 3-week hypofractionated whole-breast regimen. This phase III randomized comparison involves a control arm of whole-breast irradiation (with either conventional fractionation or hypofractionation) followed by a sequential boost in early-stage breast cancer (including DCIS) (see Variant 1, Variant 3, Variant 4, and Variant 5 above).

#### Postexcision Mammography

The use of the postexcision, preradiotherapy mammogram has previously been endorsed in a joint guideline by multiple national organizations to ensure removal of all suspicious appearing microcalcifications. It has been suggested that stereotactic localization and specimen radiography may not be enough to ensure removal of all such DCIS-associated microcalcifications given the discontinuous growth pattern along duct lumens. Clinical data are lacking, however, to support a meaningful increase in local recurrence without the use of this imaging study. A recent large single institution review indicated a postexcision mammogram would have prompted removal of residual DCIS in only 4% of cases (that would not have been re-excised regardless for margin issues), a number in keeping with other published series. The use of the postexcision mammogram was not associated with an improvement in 10-year local recurrence-free survival (94.8% versus 91.5%,  $P=0.368$ ). Though there may not be compelling evidence for routine use of postexcision mammography, it can be an essential tool in cases of questionable margins or where specimen radiography

is not done.

## Management Guidelines

### *DCIS*

Patients with DCIS are eligible for breast conservation when the area of involvement is amenable to complete surgical excision without compromise of ultimate cosmetic outcome. In general, this is defined as tumors  $\leq 4$  cm to 5 cm, but requires consideration of tumor size and location relative to breast size and patient preference for breast conservation with joint input from the surgeon and radiation oncologist. Patients with extensive microcalcifications, large tumor size relative to small breast size, involvement of more than one quadrant, or multicentric disease should be considered for mastectomy. When undergoing mastectomy, an SLNB is a reasonable staging intervention.

There is no consensus on the definition of negative margins. In general, trials using lumpectomy alone have required greater negative margin clearance (generally  $\geq 3$  mm to 10 mm) than those using definitive breast irradiation (ranging from no tumor on ink to 1 mm to 3 mm). It is clear that there is a correlation between the degree of margin clearance and local control.

Breast irradiation requires treatment to the whole breast to a total dose of 45 Gy to 50.4 Gy in standard fractionation (1.8 Gy to 2.0 Gy/day), with the option for a tumor bed boost to ensure that the total dose ranges between 50 Gy and 66 Gy, depending on pathologic findings.

It remains unclear which patients are appropriate candidates for excision alone, but early results of observation in selected DCIS patients are promising. The addition of tamoxifen in a hormone-receptor-positive DCIS patient should be considered and weighed against the side effects of the medication.

At the time of this writing, there are four phase III trials open to accrual pertaining to radiotherapy in the management of DCIS: RTOG 1005, which is comparing a hypofractionated concomitant boost whole-breast regimen with a sequential boost approach in early-stage breast cancer, NSABP B-43, which is assessing the use of adjuvant Herceptin in HER2+ DCIS patients, TROG 07.01/BIG 03-07/IBCSG 38-10, which is studying radiation doses and fractionation in DCIS, and BONBIS, which is studying the utility of tumor bed boost with whole-breast irradiation in DCIS.

### *DCIS with Microinvasion*

Eligibility for breast conservation in patients with DCIS and microinvasion requires the same clinical and pathologic considerations as those for DCIS patients with regard to tumor size, tumor location, breast size, and the feasibility of complete excision. This scenario differs, however, in the distinctly increased but low possibility of axillary node involvement and occult systemic metastatic disease. If knowledge of positive axillary nodes would prompt the recommendation for systemic therapy, an SLNB (by a surgeon experienced in this technique) may be performed, or irradiation of the axilla may be done, depending on the clinical situation.

Breast irradiation involves treatment to the whole breast to a total dose of 45 Gy to 50.4 Gy in standard fractionation, with the option for a tumor bed boost to ensure that the total dose ranges between 50 Gy and 66 Gy, depending on pathologic findings. Treatment with lumpectomy and tamoxifen without breast radiotherapy in elderly women with ER-positive microinvasive tumors following lumpectomy and negative margins may be considered.

Tamoxifen should be considered for hormone-receptor-positive patients. Aromatase inhibitors are also an option for postmenopausal patients in whom anti-endocrine therapy is being considered, and the results of two phase III studies comparing their use to that of tamoxifen for adjuvant management of DCIS are currently being analyzed (IBIS II DCIS/BIG 5-02 and NSABP B-35).

## Summary of Recommendations

- BCT therapy (consists of BCS to achieve negative margins followed by adjuvant radiation therapy to the whole breast) is an acceptable treatment alternative to mastectomy for women with localized DCIS wishing to conserve their breast.
- In selected older patients with fully excised, low-grade disease, observation may be considered after conservative surgery.
- When a mastectomy is desired or required, most surgeons will simultaneously perform an SLNB.
- Conventionally fractionated, whole-breast radiation for DCIS consists of 45 Gy to 50.4 Gy in 25 to 28 fractions, with or without a boost to the tumor bed.
- Though there are currently no phase III data to support the use of a boost in DCIS, most radiation oncologists will deliver a boost dose of 10 Gy to 16 Gy depending on age and margin status.
- PBI may be used in appropriately selected patients, but should be delivered on protocol.
- Tamoxifen should be considered in ER-positive patients with DCIS.
- DCIS with microinvasion is managed similarly to DCIS, except that SLNB is often used and regional nodal RT may be considered in

selected cases.

- Hypofractionated whole-breast radiation for DCIS is being investigated in ongoing phase III studies, but it may be considered in appropriately selected elderly patients.
- The use of MRI for DCIS remains unclear but may be considered in selected patients for whom there are concerns regarding additional disease that would alter the planned management.

#### Abbreviations

- ALND, axillary lymph node dissection
- BCT, breast conservation therapy
- DCIS, ductal carcinoma in situ
- ER, estrogen receptor
- HER2, human epidermal growth factor 2
- LCIS, lobular carcinoma in situ
- LN, lymph node
- MRI, magnetic resonance imaging
- PBI, partial breast irradiation
- PR, progesterone receptor
- RT, radiation therapy
- SLNB, sentinel lymph node biopsy
- WBRT, whole-breast radiation therapy

## Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

## Scope

### Disease/Condition(s)

Ductal carcinoma in situ (DCIS)

### Guideline Category

Management

Treatment

### Clinical Specialty

Internal Medicine

Oncology

Radiation Oncology

Radiology

Surgery

### Intended Users

Health Plans

Hospitals

Managed Care Organizations

Physicians

Utilization Management

## Guideline Objective(s)

To evaluate the appropriateness of treatment procedures for patients with ductal carcinoma in situ (DCIS)

## Target Population

Women with ductal carcinoma in situ (DCIS)

## Interventions and Practices Considered

1. Mastectomy
  - Without lymph node (LN) staging
  - With LN staging
  - With sentinel lymph node biopsy (SLNB)
  - With axillary lymph node dissection (ALND)
2. Attempt at lumpectomy
  - With adjuvant radiation therapy (RT)
  - With LN staging, adjuvant RT
3. Re-excision lumpectomy
  - Alone, no RT
  - With RT if margins negative
4. Surgical excision
  - Alone for clear margins
  - With LN staging
5. RT
  - RT Alone
  - With LN staging
  - Adjuvant RT
  - Doses (1.8–2.0 Gy/day unless otherwise specified)
6. RT volumes
  - Whole breast with boost
  - Whole breast without boost
  - Boost to tumor bed
  - Regional nodes
  - Partial breast irradiation (PBI)
  - Postmastectomy, chest wall
7. Systemic therapy
  - Tamoxifen alone (5 years)
  - Tamoxifen (after lumpectomy) and RT
  - Aromatase inhibitor (5 years)
  - Trastuzumab for 2 cycles (if human epidermal growth factor 2 [HER2]/neu+)
8. Magnetic resonance imaging (MRI), breast
  - Prior to additional surgery
  - Prior to definitive surgery
  - After ductal carcinoma in situ (DCIS) on biopsy and prior to definitive surgery



## Major Outcomes Considered

- Local recurrence rate
- Ipsilateral breast cancer recurrence rate
- Disease-free and overall survival rate
- Utility of magnetic resonance imaging (MRI) preoperatively

## Methodology

### Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

### Description of Methods Used to Collect/Select the Evidence

#### Literature Search Summary

Of the 52 citations in the original bibliography, 38 were retained in the final document. Articles were removed from the original bibliography if they were more than 10 years old and did not contribute to the evidence or they were no longer cited in the revised narrative text.

A new literature search was conducted in July 2013 to identify additional evidence published since the *ACR Appropriateness Criteria® Ductal Carcinoma in Situ* topic was finalized. Using the search strategy described in the literature search companion (see the "Availability of Companion Documents" field), 188 articles were found. Eight articles were added to the bibliography. One hundred and eighty articles were not used due to either poor study design, the articles were not relevant or generalizable to the topic, the results were unclear, misinterpreted, or biased, or the articles were already cited in the original bibliography.

The author added 31 citations not found in the literature search from bibliographies, Web sites, or books.

See also the American College of Radiology (ACR) Appropriateness Criteria® literature search process document (see the "Availability of Companion Documents" field) for further information.

### Number of Source Documents

Of the 52 citations in the original bibliography, 38 were retained in the final document. The new literature search conducted in July 2013 identified eight articles that were added to the bibliography. The author added 31 citations not found in the literature search from bibliographies, Web sites, or book.

### Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

### Rating Scheme for the Strength of the Evidence

#### Study Quality Category Definitions

Category 1 - The study is well-designed and accounts for common biases.

Category 2 - The study is moderately well-designed and accounts for most common biases.

Category 3 - There are important study design limitations.

Category 4 - The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:

- a. The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description).
- b. The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence.
- c. The study is an expert opinion or consensus document.

## Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

## Description of the Methods Used to Analyze the Evidence

The topic author assesses the literature then drafts or revises the narrative summarizing the evidence found in the literature. American College of Radiology (ACR) staff drafts an evidence table based on the analysis of the selected literature. These tables rate the study quality for each article included in the narrative.

The expert panel reviews the narrative, evidence table and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the variant table(s). Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development documents (see the "Availability of Companion Documents" field).

## Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

## Description of Methods Used to Formulate the Recommendations

### Rating Appropriateness

The American College of Radiology (ACR) Appropriateness Criteria (AC) methodology is based on the RAND Appropriateness Method. The appropriateness ratings for each of the procedures or treatments included in the AC topics are determined using a modified Delphi method. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. The expert panel members review the evidence presented and assess the risks or harms of doing the procedure balanced with the benefits of performing the procedure. The direct or indirect costs of a procedure are not considered as a risk or harm when determining appropriateness. When the evidence for a specific topic and variant is uncertain or incomplete, expert opinion may supplement the available evidence or may be the sole source for assessing the appropriateness.

The appropriateness is represented on an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate" where the harms of doing the procedure outweigh the benefits; and 7, 8, or 9 are in the category "usually appropriate" where the benefits of doing a procedure outweigh the harms or risks. The middle category, designated "may be appropriate," is represented by 4, 5, or 6 on the scale. The middle category is when the risks and benefits are equivocal or unclear, the dispersion of the individual ratings from the group median rating is too large (i.e., disagreement), the evidence is contradictory or unclear, or there are special circumstances or subpopulations which could influence the risks or benefits that are embedded in the variant.

The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating. To determine the panel's recommendation, the rating category that contains the median group rating without disagreement is selected. This may be determined after either the first or second rating round. If there is disagreement after the second rating round, the recommendation is "may be appropriate."

This modified Delphi method enables each panelist to articulate his or her individual interpretations of the evidence or expert opinion without excessive influence from fellow panelists in a simple, standardized and economical process. For additional information on the ratings process see the [Rating Round Information](#)  document on the ACR Web site.

Additional methodology documents, including a more detailed explanation of the complete topic development process and all ACR AC topics can be found on the [ACR Web site](#)  (see also the "Availability of Companion Documents" field).

## Rating Scheme for the Strength of the Recommendations

Not applicable

## Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

## Method of Guideline Validation

Internal Peer Review

## Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

## Evidence Supporting the Recommendations

### Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current literature and expert panel consensus.

#### Summary of Evidence

Of the 77 references cited in the *ACR Appropriateness Criteria® Ductal Carcinoma in Situ* document, 59 are categorized as therapeutic references including 10 well-designed studies, and 21 good quality studies. Additionally, 18 references are categorized as diagnostic references including 2 good quality studies, and 8 quality studies that may have design limitations. There are 36 references that may not be useful as primary evidence.

While there are references that report on studies with design limitations, 33 well-designed or good quality studies provide good evidence.

## Benefits/Harms of Implementing the Guideline Recommendations

### Potential Benefits

Selection of appropriate procedures for the treatment and management of patients with ductal carcinoma in situ (DCIS)

## Potential Harms

- The disadvantages of breast magnetic resonance imaging (MRI) include high false-positive rates potentially requiring unnecessary further workup and additional invasive procedures, delay of definitive treatment for the known malignancy, and increased anxiety for the patient.
- Adverse effects of therapy, including side effects of medication and toxicity of radiation therapy

## Contraindications

### Contraindications

Observation is contraindicated in premenopausal patients with high-grade tumor.

## Qualifying Statements

### Qualifying Statements

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

## Implementation of the Guideline

### Description of Implementation Strategy

An implementation strategy was not provided.

## Institute of Medicine (IOM) National Healthcare Quality Report Categories

### IOM Care Need

Getting Better

Living with Illness

### IOM Domain

Effectiveness

# Identifying Information and Availability

## Bibliographic Source(s)

Kaufman SA, Harris EER, Bailey L, Chadha M, Dutton SC, Freedman GM, Goyal S, Halyard MY, Horst KC, Novick KLM, Park CC, Suh WW, Toppmeyer D, Zook J, Haffty BG, Expert Panel on Radiation Oncology—Breast. ACR Appropriateness Criteria® ductal carcinoma in situ [online publication]. Reston (VA): American College of Radiology (ACR); 2014. 20 p. [77 references]

## Adaptation

Not applicable: The guideline was not adapted from another source.

## Date Released

1996 (revised 2014)

## Guideline Developer(s)

American College of Radiology - Medical Specialty Society

## Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

## Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Radiation Oncology – Breast

## Composition of Group That Authored the Guideline

*Panel Members:* Seth A. Kaufman, MD (*Principal Author*); Eleanor E. R. Harris, MD (*Panel Vice-chair*); Lisa Bailey, MD; Manjeet Chadha, MD; Sharon C. Dutton, MD; Gary M. Freedman, MD; Sharad Goyal, MD; Michele Y. Halyard, MD; Kathleen C. Horst, MD; Kristina L. M. Novick, MD; Catherine C. Park, MD; W. Warren Suh, MD; Deborah Toppmeyer, MD; Jennifer Zook, MD; Bruce G. Haffty, MD (*Panel Chair*)

## Financial Disclosures/Conflicts of Interest

Not stated

## Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Moran MS, Bai HX, Haffty BG, Harris EE, Arthur DW, Bailey L, Bellon JR, Carey L, Goyal S, Halyard MY, Horst KC, MacDonald SM, Expert Panel on Radiation Oncology-Breast. ACR Appropriateness Criteria® ductal carcinoma in situ. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 14 p. [52 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

## Guideline Availability

Electronic copies: Available from the [American College of Radiology \(ACR\) Web site](#) .

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

## Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2015 Feb. 3 p. Electronic copies: Available from the [American College of Radiology \(ACR\) Web site](#) .
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2015 Feb. 1 p. Electronic copies: Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Evidence table development – diagnostic studies. Reston (VA): American College of Radiology; 2013 Nov. 3 p. Electronic copies: Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Evidence table development – therapeutic studies. Reston (VA): American College of Radiology; 2013 Nov. 4 p. Electronic copies: Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria® ductal carcinoma in situ. Evidence table. Reston (VA): American College of Radiology; 2014. 31 p. Electronic copies: Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria® ductal carcinoma in situ. Literature search. Reston (VA): American College of Radiology; 2014. 1 p. Electronic copies: Available from the [ACR Web site](#) .

## Patient Resources

None available

## NGC Status

This NGC summary was completed by ECRI Institute on August 29, 2006. This summary was updated by ECRI Institute on March 27, 2012. This summary was updated by ECRI Institute on August 3, 2015.

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